

Appln No. 10/716,812
Amdt date February 1, 2007
Reply to Office action of November 2, 2006

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Please amend claims 1, 3-7, 11, 13-15, 18, 19, 22, 23, 25 and 27-29, and canceled claims 10 and 24.

1. (Currently Amended) An electrolyte for a lithium secondary battery, comprising a non-aqueous organic solvent including 20 to 95 vol% of an ester-based or ether-based organic solvent based on total amount of organic solvent; one or more lithium salts; and an additive compound having at least two carbonate groups and at least one carbon-to-carbon double bond.

2. (Original) The electrolyte for a lithium secondary battery according to claim 1, wherein the ester-based or ether-based organic solvent is used in an amount of 30 to 95 vol%.

3. (Currently Amended) The electrolyte for a lithium secondary battery according to claim 1, wherein the non-aqueous organic solvent is an ester-based organic solvent selected from the group consisting of γ -butyrolactone (γ -BL), n-methyl acetate, n-ethyl acetate, and n-propyl acetate.

4. (Currently Amended) The electrolyte for a lithium ~~secondary~~ secondary battery according to claim 1, wherein the ether-based organic solvent is dibutyl ether.

5. (Currently Amended) The electrolyte for a lithium secondary battery according to claim 1, wherein the ~~electrolyte~~ non-aqueous organic solvent further comprises a solvent selected from the group consisting of [[a]] carbonate-based solvent solvents, and or a mixture mixtures of [[a]] carbonate-based solvent solvents and [[an]] aromatic hydrocarbon organic solvent solvents.

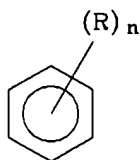
Appln No. 10/716,812

Amdt date February 1, 2007

Reply to Office action of November 2, 2006

6. (Currently Amended) The electrolyte for a lithium secondary battery according to claim 5, wherein the ~~electrolyte comprises a~~ carbonate-based solvent is selected from the group consisting of dimethyl carbonate (DMC), diethyl carbonate (DEC), methylpropyl carbonate (MPC), ethylpropyl carbonate (EPC), methylethyl carbonate (MEC), ethylene carbonate (EC), propylene carbonate (PC), butylene carbonate (BC), and mixtures thereof.

7. (Currently Amended) The electrolyte for a lithium secondary battery according to claim 5, wherein the non-aqueous organic solvent ~~electrolyte~~ comprises an aromatic hydrocarbon organic solvent represented by Formula (1):



(1)

wherein R is selected from the group consisting of a halogen or a halogens and C₁ to C₁₀ alkyl alkyls, and n is an integer [[of]] ranging from 0 to 6.

8. (Original) The electrolyte for a lithium secondary battery according to claim 1, wherein the one or more lithium salts are selected from the group consisting of LiPF₆, LiBF₄, LiSbF₆, LiAsF₆, LiClO₄, LiCF₃SO₃, Li(CF₃SO₂)₂N, LiC₄F₉SO₃, LiSbF₆, LiAlO₄, LiAlCl₄, LiN(C_xF_{2x+1}SO₂)(C_yF_{2y+1}SO₂), where x and y are natural numbers, LiCl, and LiI.

9. (Original) The electrolyte for a lithium secondary battery according to claim 8, wherein the one or more lithium salts are present in a concentration ranging from 0.6 to 2.0 M.

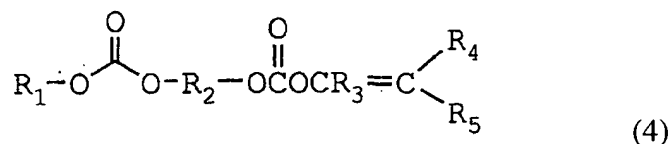
10. (Canceled).

11. (Currently Amended). The electrolyte for a lithium secondary battery according to claim [[10]] 1, wherein each of the at least two carbonate groups carbonates is independently

selected from ~~comprise~~ cyclic ~~and/or~~ and linear carbonates.

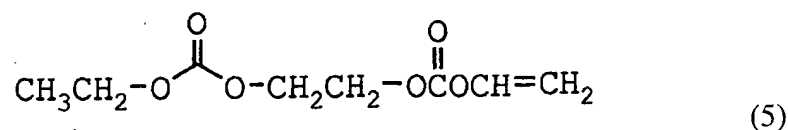
12. (Original) The electrolyte for a lithium secondary battery according to claim 11, wherein the additive compound comprises a cyclic carbonate bound with a cyclic carbonate; a linear carbonate bound with a linear carbonate; or a cyclic carbonate bound with a linear carbonate.

13. (Currently Amended) ~~[[The]]~~ An electrolyte for a lithium secondary battery ~~according to claim 12, comprising a non-aqueous organic solvent including 20 to 95 vol% of an ester-based or ether-based organic solvent based on a total amount of organic solvent; one or more lithium salts; and an additive compound having at least two carbonate groups,~~ wherein the additive compound is a carbonic acid ester compound of the following Formula (4):



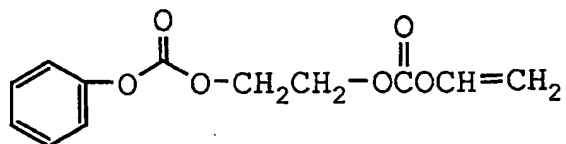
wherein R₁ is hydrogen, a C₁ to C₆ alkyl, or a C₆ to C₁₂ aryl; R₂ is (CH₂)_n, where n is an integer of 1 to 6; R₃ is hydrogen, a C₁ to C₆ alkyl, or a C₆ to C₁₂ aryl; and R₄ and R₅ are each independently hydrogen or a C₁ to C₆ alkyl.

14. (Currently Amended) The electrolyte for a lithium secondary battery according to claim 13, wherein the ~~carbonic acid ester~~ additive compound is selected from the group consisting of a compound of Formula (5):



a compound of Formula (6):

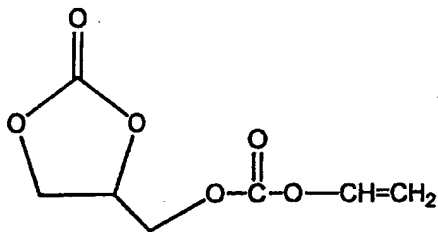
Appln No. 10/716,812
 Amdt date February 1, 2007
 Reply to Office action of November 2, 2006



(6)

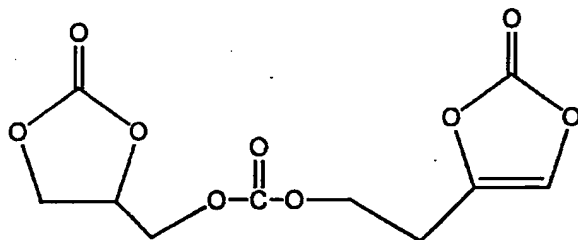
and a mixture thereof.

15. (Currently Amended) [[The]] An electrolyte for a lithium secondary battery ~~according to claim 11, comprising a non-aqueous organic solvent including 20 to 95 vol% of an ester-based or ether-based organic solvent based on total amount of organic solvent; one or more lithium salts; and an~~ wherein the additive compound [[is]] represented by the following Formula (2):



(2)

or Formula (3):



(3).

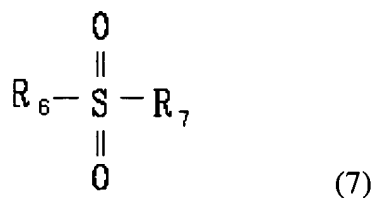
16. (Original) The electrolyte for a lithium secondary battery according to claim 1, wherein the additive compound is present in an amount of 0.1 to 10 wt% based on the total amount of the electrolyte.

17. (Original) The electrolyte for a lithium secondary battery according to claim 1, wherein the electrolyte further comprises a secondary additive compound selected from the group consisting of vinylene carbonates, organic sulfone-based compounds, and mixtures thereof.

18. (Currently Amended) The electrolyte for a lithium secondary battery according to claim 17, wherein the secondary additive comprises a vinylene carbonate [[is]] present in an amount of 0.1 to 50 wt% based on the total amount of the electrolyte.

19. (Currently Amended) The electrolyte for a lithium secondary battery according to claim 17, wherein the secondary additive comprises a organic sulfone-based compound [[is]] present in an amount of 0.1 to 5 wt% based on the total amount of the electrolyte.

20. (Original) The electrolyte for a lithium secondary battery according to claim 17, wherein the secondary additive compound is an organic sulfone-based compound represented by the following Formula (7):



wherein R₆ and R₇ are each independently selected from the group consisting of primary, secondary, and tertiary alkyl groups, alkenyl groups, aryl groups, and cycloalkyl groups.

21. (Original) The electrolyte for a lithium secondary battery according to claim 20, wherein one of R₆ and R₇ is an alkenyl.

22. (Currently Amended) The electrolyte for a lithium secondary battery according to claim [[16]] 17, wherein the secondary additive compound is vinyl sulfone.

23. (Currently Amended) A lithium secondary battery comprising a positive electrode comprising a material that is capable of reversible intercalation/deintercalation of lithium ions;

a negative electrode comprising a negative active material selected from the group consisting of [[a]] lithium metal, [[a]] lithium-containing alloy alloys, or a material that is materials capable of reversible intercalation/deintercalation of lithium ions as a negative active material, or a material that is and materials capable of reversibly forming [[a]] lithium-containing compound compounds as a negative active material;

a separator interposed between the positive and negative electrodes; and

an electrolyte comprising a non-aqueous organic solvent including 20 to 95 vol% of an ester-based or ether-based organic solvent based on the total amount of organic solvent; one or more lithium salts; and an additive compound having at least two carbonate groups and at least one carbon-to-carbon double bond.

24. (Canceled).

25. (Currently Amended). The lithium secondary battery according to claim [[24]] 23, wherein each of the at least two carbonate groups comprise carbonates is selected from cyclic [[or]] and linear carbonates.

26. (Original) The lithium secondary battery according to claim 25, wherein the additive compound comprises a cyclic carbonate bound with a cyclic carbonate; a linear carbonate bound with a linear carbonate; or a cyclic carbonate bound with a linear carbonate.

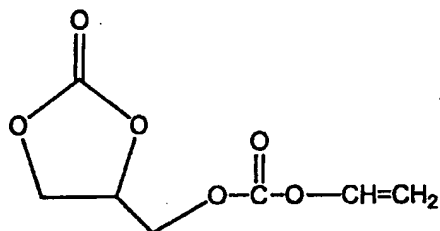
27. (Currently Amended) ~~[[The]]~~ A lithium secondary battery according to claim 26 comprising a positive electrode comprising a material that is capable of reversible intercalation/deintercalation of lithium ions;

a negative electrode comprising a negative active material selected from the group consisting of lithium metal, lithium-containing alloys, materials capable of reversible

intercalation/deintercalation of lithium ions, and materials capable of reversibly forming lithium-containing compounds;

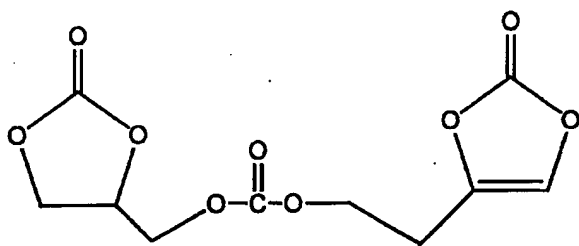
a separator interposed between the positive and negative electrodes; and

an electrolyte comprising a non-aqueous organic solvent including 20 to 95 vol% of an ester-based or ether-based organic solvent based on the total amount of organic solvent; one or more lithium salts; and an additive compound having at least two carbonate groups, wherein the additive compound is represented by Formula (2):



(2), and

compounds represented by Formula (3):



(3).

28. (Currently Amended) [[The]] A lithium secondary battery according to claim 26, comprising:

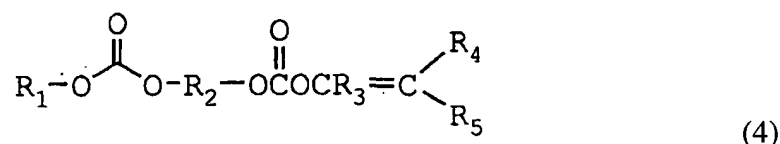
a positive electrode comprising a material that is capable of reversible intercalation/deintercalation of lithium ions;

a negative electrode comprising a negative active material selected from the group consisting of lithium metal, lithium-containing alloys, materials capable of reversible intercalation/deintercalation of lithium ions, and materials capable of reversibly forming lithium-

Appln No. 10/716,812
 Amdt date February 1, 2007
 Reply to Office action of November 2, 2006

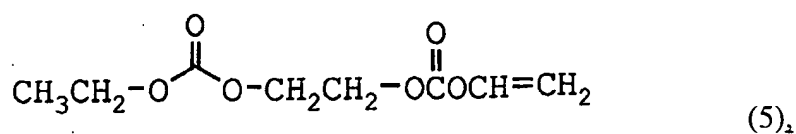
containing compounds;

a separator interposed between the positive and negative electrodes; and
an electrolyte comprising a non-aqueous organic solvent including 20 to 95 vol% of an
ester-based or ether-based organic solvent based on the total amount of organic solvent; one or
more lithium salts; and an additive compound, wherein the additive compound is a carbonic acid
ester compound of the following Formula (4):

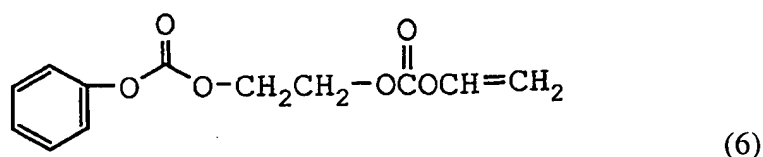


wherein R₁ is selected from the group consisting of hydrogen, [[a]] C₁ to C₆ alkyl alkyls, [[or a]]
and C₆ to C₁₂ aryl aryls; R₂ is (CH₂)_n, where n is an integer [[of]] ranging from 1 to 6; R₃ is
selected from the group consisting of hydrogen, [[a]] C₁ to C₆ alkyl alkyls, [[or a]] and C₆ to C₁₂
aryl aryls; and R₄ and R₅ are each independently selected from the group consisting of [[a]]
hydrogen [[or a]] and C₁ to C₆ alkyl alkyls.

29. (Currently Amended) The lithium secondary battery according to claim 28,
 wherein the ~~carbonic acid ester~~ additive compound is selected from the group consisting of [[a]]
~~compound of~~ compounds represented by Formula (5):



a ~~compound of~~ compounds represented by Formula (6):



Appln No. 10/716,812
Amdt date February 1, 2007
Reply to Office action of November 2, 2006

and ~~a mixture~~ mixtures thereof.

30. (Original) The lithium secondary battery according to claim 23, wherein the additive compound is present in an amount of 0.1 to 10 wt% based on the total amount of the electrolyte.

31. (Original) The lithium secondary battery according to claim 23, wherein the electrolyte further comprises a secondary additive compound selected from the group consisting of vinylene carbonates, organic sulfone-based compounds, and mixtures thereof.

32. (Original) The lithium secondary battery according to claim 23, wherein the positive active material is a lithium-nickel-based or a lithium-nickel-manganese-based compound.